

REMARKS

By amendments made herein, all of Applicants' pending claims are method claims directed to electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches using an electroplating composition that comprises one or more brightener compounds that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition, and wherein one or more brightener compounds comprise bis-sulfonopropyl disulfide.

The specification and claims 124, 137, 154, 160 have been amended, and claims 138, 139, 156, and 157 have been cancelled without prejudice. No new matter has been added by virtue of the amendments. Indeed, the amendments made herein were requested in the Office Action to add further clarity.

Claims 124-132, 134-139, 141-156 and 158-167 were rejected under 35 U.S.C. 112, first paragraph. As grounds for the rejection, the term "sulfonopropyl disulfide compound" is noted. The rejection is traversed.

While Applicants fully disagree with the rejection, the pending claims call for "bis-sulfonopropyl disulfide". That claim language is fully supported by the application as filed. Among other things, the bis-sulfonopropyl disulfide compound is exemplified in the examples of the application.

In view thereof, reconsideration and withdrawal of the rejection is requested.

Claims 124-132, 134-139, 141-156 and 158-167 were rejected under 35 U.S.C. 112, second paragraph. The rejection is traversed.

While Applicants disagree with the rejection, it is also believed the rejection has been obviated by the amendments made herein. The claims consistently recite “sulfonopropyl”. The claims also recite “bis-sulfonopropyl disulfide”.

In view thereof, withdrawal of the rejection is requested.

As noted at page 3 of the Office Action, the specification also was objected to for recitation of “sulfopropyl”.

In accordance with the Examiner’s recommendation, the specification has been amended to consistently recite “sulfonopropyl”.

Claims 124-132, 134-139, 141-156 and 158-167 were rejected under 35 U.S.C. 103 over Beach (U.S. Patent 4,334,966) in view of Bernards et al. (U.S. Patent 5,051,154) and further in view of Dubin et al. (U.S. Patent 5,972,192).

The skilled would not have had any incentive to carefully combine selected aspects of the cited documents as proposed by the instant rejection.

Thus, the primary citation of Beach et al. is directed to plating *gravure rolls* (a type of printed plate). Thus, the primary citation is outside the electronics industry. Clearly, the skilled worker would not look to gravure rolls for materials to plate much different semiconductor wafers.

Bernards is also quite distinct and pertains to plating on printed circuit boards. As discussed in Applicants’ prior responses, persons skilled in the art recognize that plating on copper on a microchip wafer is considerably more difficult, and possess unique issues, relative to plating copper on a printed circuit board. See Applicants’ response filed November 2, 2002 and the references discussed therein. Indeed, prior rejections based on reasoning similar to the present rejection have been withdrawn.

The Dubin document adds little and reports a certain pulse-plating sequence. No incentive would have existed to modify the Dubin system based on the primary citation of Beach (which is specifically directed to gravure rolls) or Bernards (printed circuit boards). Nor do Beach or Bernards provide any suggestion that the reported compositions could be employed in a pulse-plating procedure.

Moreover, while Applicants fully believe that a *prima facie* case of obviousness has not been presented by the cited documents, it is also believed that the comparative data of record effectively rebuts any *prima facie* case that may be contended to exist.

Attention is directed to the comparative results detailed at Examples 2 and 3 of the application. In Example 2, using a copper electroplating composition of the invention, semiconductor microvias having 200 nm diameters and 7:1 aspect ratios were filled with copper deposits having no defects as determined by focused beam examination. In comparative Example 3, a copper electroplating composition having a brightener concentration of 0.35 mg/l produced a copper deposit with defects in microvias having diameter of 200 nm and 4:1 aspect ratio.

In view thereof, withdrawal of the rejection is requested.

Claims 124-132, 134-139, 141-156 and 158-167 were rejected under 35 U.S.C. 103 over Dahms et al. (U.S. Patent 3,778,357) in view of Dubin et al. (U.S. Patent 5,972,192) and further in view of Bernards et al. (U.S. Patent 5,068,013). As noted at page 5 of the Office Action:

Dahms et al do not teach using (1) a suppressor agent, such as a polyether, in the electroplating solution or (2) a sulfonopropyl disulfide compound as the brightener.

However, the position is taken that the Bernard document reports use of a suppressor agent and bisulfonopropyl as a brightener, and that it would have been obvious to substitute such materials into the Dahms et al. composition.

The rejection is traversed.

Dahms et al. does *not disclose any specific type of substrate for plating*. As mentioned above, the Bernards document is directed to printed circuit boards, whereas the Dubin documents reports a specific pulse-plating sequence.

Clearly, the skilled worker would not had no incentive to so carefully combine selected aspects of Dahms et al., Dubin et al. and Bernards et al. as proposed by the instant rejection. Indeed, the priority dates of the three citations span 25 years and no report existed during that time of the proposed combination of record.

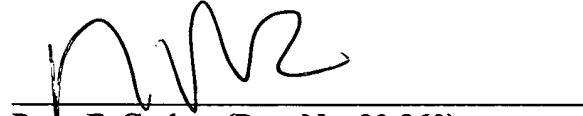
In fact, the cited documents themselves fairly teach against the proposed combination. For instance, Dubin et al. reports use of a pulse-plating sequence to improve plating of vias. In that pulse plating sequence, use of relatively low concentration brightener is reported. See Dubin et al. at column 8, lines 4-16. In clear distinction, Dahms reports use of certain phosphonium ion compounds for plating at high current densities. In other words, the cited documents advance different goals to resolve the stated technical difficulty; those distinct goals of each of the cited documents indicate that the skilled worker clearly would not have had any incentive to make the proposed combination.

Moreover, as discussed above, it is also believed that the comparative data of record effectively rebuts any *prima facie* case that may be contended to exist.

In view thereof, reconsideration and withdrawal of the rejection are requested.

It is believed the application is in condition for immediate allowance, which action is earnestly solicited.

Respectfully submitted,



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